COURSE SYLLABUS

GEO 6600/7600 Geodynamics

Fall 2010 TR 12:00—1:15 rm 217A

Professor: Tony Lowry (Department of Geology)
- Geology Bldg Room 106 (Phone: 797-7096)
- Email: Tony.Lowry@usu.edu
- Office Hours: TR 1:30—4:00pm (or by appt)

COURSE DESCRIPTION

This course will introduce (and survey current literature on) the field of geodynamics, the study of dynamical processes of the solid Earth. As such, it is rooted in fundamental physics and highly interdisciplinary. The important elements of geodynamics are the same line-up of "Usual Suspects" that you find everywhere in environmental physics: Namely, energy, fluxes of energy and material, and material properties. Energy in the Earth's interior is dominantly thermal, gravitational potential, and strain potential (but others can be important!) Consequently much of this course will deal with inter-relationships of heat transfer, gravity, mass density and deformation.

Much of this course will revolve around introductory materials and current papers relating to geodynamics of the lithosphere and asthenosphere. Roughly a third of your effort will involve solving problem sets and doing some relatively simple modeling exercises using standard codes (which we will learn together as a group). Another third will involve reading and discussing critically the physics, measurements and observations underlying some current papers on relevant topics, and the remainder will be devoted to a semester project on a topic of your choosing (presumably, something related to your thesis topic). I will attempt to skew the course materials a bit toward the topics and interests of students taking the course. Students taking the course for 7000 level credit will be expected to undertake some development of modeling tools beyond that required of 6000 level students.

The course materials will have three main goals: (1) To introduce some fundamentals of geodynamics (from Turcotte & Schubert); (2) To familiarize ourselves with some basic modeling tools; and (3) To survey the recent literature on exciting new developments in understanding dynamical behavior of the solid Earth.

About the professor:
I am a geophysicist. My research focuses on measuring and understanding how and why planets deform, and particularly the rheological relationships that modulate processes of ductile flow, fault slip, earthquakes and volcanism. Elements of my research also have implications for mass transfer in the atmosphere, hydrosphere and cryosphere.

Course Text:
Geodynamics: Second Edition. D.L. Turcotte and G. Schubert, Cambridge (NY).
Selected journal articles.

(Approximate) Schedule of Topics:

Date	Topic	Reading
31 Aug	Introduction to the course; Intro Lithosphere	
2 Sep	Lithosphere as thermal boundary layer: Conductive heat transfer; radiogenic heating	T&S 132-147
7 Sep	Time-dependence (cooling & heating)	T&S 147-162
9 Sep	Temperature and density	T&S 171-177 Roy & al (2009)
14 Sep	Advective heat transfer processes	162-171; 179-183; Crossey & al (2009)
16 Sep		Yardley (2009)
21 Sep	Intro Asthenosphere: The adiabat; fluid flow	T&S 185-190; 226-238
23 Sep	Convection; plumes Asthenosphere = Convection?	254-261; 266-280; Kellogg & al (1999)
28 Sep	Subduction as downwelling	McNamara & Zhong (2005)
30 Sep	Delamination and drips as downwelling	T&S 244-249; Zandt & al (2004)
5 Oct		West & al (2009)
7 Oct	Rheology	T&S 292-323
12 Oct	(No class: Prof out of town)	
14 Oct	(No class: Friday class schedule)	
19 Oct		Bürgmann & Dresen (2009)
21 Oct	Frictional rheology: seismogenic layer = lithosphere?	339-355
26 Oct	Flexural Isostasy (Lithosphere as strong layer)	105-130
2 Nov	Flexural strength as lithosphere	Watts & Burov (2003)
4 Nov		Pérez-Gussinyé & al (2009)
9 Nov	Rheological implications of flexural rigidity	Lowry et al. (2000)
11 Nov		Lowry & P-G (2010)
16 Nov	Lithosphere = Tectonic Plate?	Mierdel & al (2007)
18 Nov	Viscoelasticity: Asthenosphere from rebound?	T&S 238-241
23 Nov		Willett & al (1985)
25 Nov	Happy Thanksgiving…	
30 Nov	Major element chemistry: Lithosphere as tectosphere	
2 Dec		Forte & Perry (2000); Schutt & Lesher (2006)
7 Dec	Geochemistry: Asthenosphere as mixed reservoir	T&S 410-427
9 Dec	Present Final Semester Projects	

Write-up of Semester Projects Due 9 Dec at class-time

Updated course schedule and powerpoint lectures will be at
http://anquetil.colorado.edu/~arlowry/Geodyn/index.html

Grading:

Exercises	30%
Class discussions/discussion leads	30%
Semester Project and Presentation	40%

Notice to students with disabilities: Students with physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations in accordance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973. If you have a disability that will likely require some accommodation by the instructor, you must contact the instructor and document the disability through the Disability Resource Center (DRC) in Room 101 of the University Inn, 797-2444 voice, 797-0740 TTY, or toll free at 1-800-259-2966, preferably during the first week of the course. Any requests for special considerations relating to attendance, pedagogy, taking of examinations, etc. must be discussed with and approved by the instructor. In cooperation with the Disability Resource Center, course materials can be provided in alternative formats--large print, audio, diskette or Braille.